



WARM USER'S GUIDE

Calculating Greenhouse Gas Emissions With the WASTE Reduction Model

WHAT IS THE WASTE REDUCTION MODEL?

The WASTE Reduction Model (WARM) was created by the U.S. Environmental Protection Agency (EPA) to help solid waste planners and organizations estimate greenhouse gas (GHG) emission reductions from several different waste management practices. WARM is available in a Web-based calculator format and as a Microsoft Excel® spreadsheet. Both versions of WARM are available on EPA's Web site at www.epa.gov/mswclimate.

WARM calculates and totals GHG emissions of baseline and alternative waste management practices—source reduction, recycling, combustion, composting, and landfilling. The model calculates emissions in metric tons of carbon equivalent (MTCE)¹ across a wide range of material types that compose municipal solid waste (MSW). In addition, the Microsoft Excel® version can break down emission results by type of GHG (carbon dioxide, methane, etc.). The user can construct various scenarios by simply entering data on the amount of waste handled by material type and by management practice. WARM then automatically applies emissions factors specific to material type and management practice to calculate the GHG emissions of each scenario. Several key inputs, such as landfill gas collection and transportation distances to MSW facilities, can be modified by the user.



The GHG emissions factors were developed following a life-cycle assessment methodology using estimation techniques developed for national inventories of GHG emissions. EPA's report *Greenhouse Gas Emissions From Management of Selected Materials in Municipal Solid Waste* (EPA 530-R-98-013) describes this methodology in detail. For a free copy of this report, visit www.epa.gov/mswclimate or call EPA's RCRA hotline at 800 424-9346.

WHO SHOULD USE WARM?

WARM was developed for solid waste managers (from state and local governments and other organizations) who want to calculate the GHG emissions associated with different waste management options. Emissions estimates provided by WARM are intended to support voluntary GHG measurement and reporting initiatives. These initiatives include waste manage-

ment components of climate change action plans, the Department of Energy's 1605(b) voluntary program for reporting GHG emissions, and other waste management projects for which an understanding of GHG emissions is desired.

USING WARM

Before using WARM, you first need to gather data on your baseline waste management practices and an alternative scenario.

¹MTCE is a unit of measurement that expresses the heat-trapping effects of various greenhouse gas emissions in carbon equivalents. An international protocol has established carbon dioxide (CO₂) as the reference gas.

You should know how many tons of waste you manage (or would manage) for a given time period under each scenario by material type and by management practice.

Both models allow you to customize your results based on project specific landfill gas recovery practices and transportation distances. Note that you may use default values if you are unsure of landfill gas recovery practices and/or transportation distances.

Web-based Version:

- To use the web-based version of WARM, you will need Internet Explorer or Netscape versions 4 or higher.
- For the web-based WARM model to be able to calculate your GHG emissions you must enter the tons of each material type managed into the baseline and alternative management tables. The boxes in the baseline and alternative tables correspond to specific material types and management practices. Be sure to enter your data in the correct boxes.

MSW Material Types Recognized by WARM

Newspaper	Glass	Food Discards
Office Paper	HDPE	Yard Trimmings
Corrugated Boxes	LDPE	Mixed Recyclables
Mixed Paper*	PET	
Aluminum Cans	Dimensional Lumber	
Steel Cans	Medium Density Fiberboard	

* Broad, Residential, and Office

Answer the questions pertaining to landfill gas recovery and transportation distance by selecting the appropriate toggle buttons. If the requested data is not available, WARM will use the national average defaults.

- Once you've completed the tables and answered all of the questions on the inputs page, WARM has all the information it needs to calculate the GHG emissions associated with the baseline and alternative waste management scenarios you specified. Click "create summary" to see your results.

- The summary sheet provides a concise report of GHG emissions from the baseline and alternative waste management scenarios, as well as a net emissions figure.

Once you have seen your results, you can return to the inputs page to run additional scenarios by selecting the button labeled "exit summary."

Alternatively, you can view the emission factors used to estimate emissions for various materials and management practices; note that these emission factors will reflect national average default values for landfill gas recovery and transportation distances. To access these emission factors, select the button labeled "view emission factors" from either the inputs page or the summary page.

Microsoft Excel® Version:

- To use Microsoft Excel® WARM, you will need Microsoft Excel® version 5.0 or higher.
- Once you've gathered these data, you're ready to get started with WARM. Follow directions on the Web site for downloading and installing the Microsoft Excel® version of WARM. After successfully downloading the file, open the spreadsheet. WARM will prompt you with "Open as read-only?" If you plan to save your work in WARM, click "No." Otherwise, click "Yes." Next, WARM will prompt you with "This document contains links. Re-establish links?" Simply click "No."

The screenshot shows a Microsoft Excel spreadsheet titled "GHG Emissions Analysis - Summary Report". The spreadsheet is organized into several sections. The top section, labeled "1. GHG Emissions from Baseline Waste Management Analysis", contains a table with columns for "Material Type", "Tons", "Emission Factor", and "Total Emissions". Below this, there is a section for "2. GHG Emissions from Alternative Waste Management Analysis", which also includes a similar table. The bottom section, labeled "3. Total Change in GHG Emissions", provides a summary of the results, including a "Total Change in GHG Emissions" and a "Net Emissions" figure. The spreadsheet is displayed in a standard Excel interface with a menu bar and a toolbar.

WARM Summary Report

■ Now, click on the “Analysis Inputs” tab at the bottom center of the screen to open the input sheet. Follow the instructions for Steps 1 and 2 to fill in the tables describing your baseline and proposed alternative waste management scenarios.

■ Fill in the data requested in Steps 3–6. In these steps, WARM is asking for additional waste handling information to allow it to customize its calculations to your waste management situation. For example, you are asked for data on transportation distances and on your landfill gas and ferrous metal recovery systems, if applicable. If the requested data is not available, WARM will use the national average defaults.

■ Once you’ve completed Steps 1–6 on the “Analysis Inputs” sheet, WARM has the information it needs to calculate the GHG emissions attributable to the baseline and alternative waste management scenarios you’ve specified. Emissions calculations are presented on three separate output sheets, as described below. From the “Analysis Inputs” sheet, click on a tab at the bottom of the screen for the results sheet you want to view first.

—The “Analysis Results” sheet shows GHG emissions for each scenario in units of MTCE. You can compare the total impact of the baseline and alternative scenarios, or, if you want more detail, you can scroll down to view GHG emissions per material type and management practice.

—The “Analysis Results by Gas” sheet provides a breakout of emissions of specific GHGs per material type under each scenario. The specific GHGs are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and perfluorocarbons (CF₄ and C₂F₆).

—The “Summary Report” sheet provides a concise report of GHG emissions from the baseline and alternative waste management scenarios, as well as a net total MTCE figure.

Assistance

If you need additional assistance with using WARM, please email Henry Ferland at ferland.henry@epa.gov or Eugene Lee at lee.eugene@epa.gov.